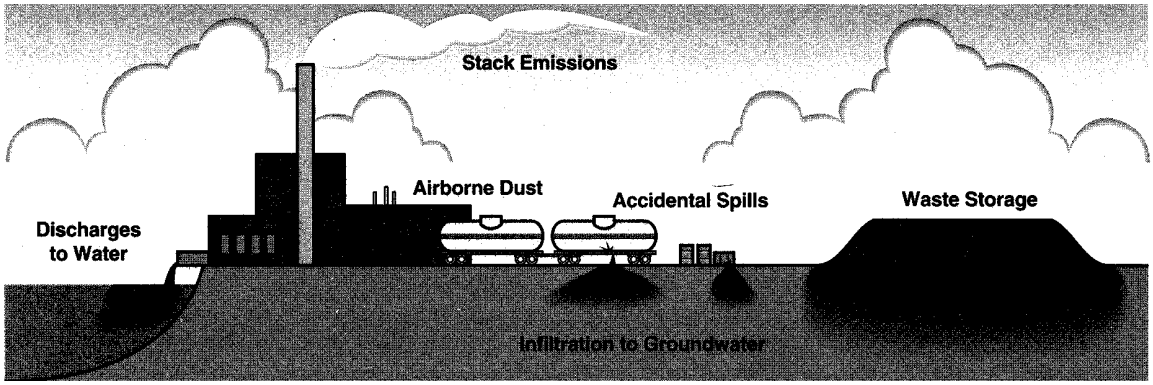
Savannah River Site fact sheet

Source Term Estimates



Sources of material released from the Savannah River Site

The source term refers to the amounts, chemical forms, and frequency of releases of chemical and radioactive materials to the environment from the Savannah River Site (SRS). Beginning in 1953, the U.S. Government made and processed material used for the fabrication of nuclear weapons, primarily tritium and plutonium-239, at the SRS.

Phase II of the SRS Environmental Dose Reconstruction Project will determine past releases of chemical and radioactive materials. The project is being conducted by *Radiological Assessments Corporation* under a contract with the Centers for Disease Control and Prevention.

Defining source terms, the release histories of the materials, is the most important technical task of dose reconstruction. It is the first stage in the series of calculations performed to determine the radiation and chemical doses received by people who were exposed to materials released from the SRS in the past. Based on the source terms and other information about the ways people may have been exposed to contaminants, scientists working in later phases of the project will calculate the amount of exposure people could have received.

The estimated amounts of radioactive materials released from a source are expressed in units of radioactivity released over a specified time period, such as curies per year or becquerels per month. Releases of nonradioactive materials are expressed in units of weight per time period, such as grams per second or tons per year.

Types of Releases

Releases to the environment that occurred as a result of normal operations are considered routine releases. Unplanned releases that occurred when pollution control equipment failed or another kind of failure occurred are called accidental releases. Examples of accidental releases are fuel failures, pipe breaks, storage tank leaks, and air filter failures.

Many forms of radioactive materials were released from the Site. Gases, particles carried in air, liquid wastes released from seepage basins to streams and creeks, and buried wastes that may have migrated into ground water will all be considered. Separate source terms will be developed for releases to the air, surface water, and ground water. Releases to ponds, lakes, rivers, creeks, or streams will make up the surface water source term.

The ground water source term will include chemicals and radioactive materials in waste that was buried or stored in tanks that may have leaked. It will also include materials in surface ponds, seepage basins, and trenches that may have seeped down into the ground. Contaminants in the soil can be carried into the ground water by rain or wastewater. Tritium, for example, is very mobile and could have easily reached shallow ground water. When the ground water carries materials into streams or ponds, these materials contribute to the surface water source term.

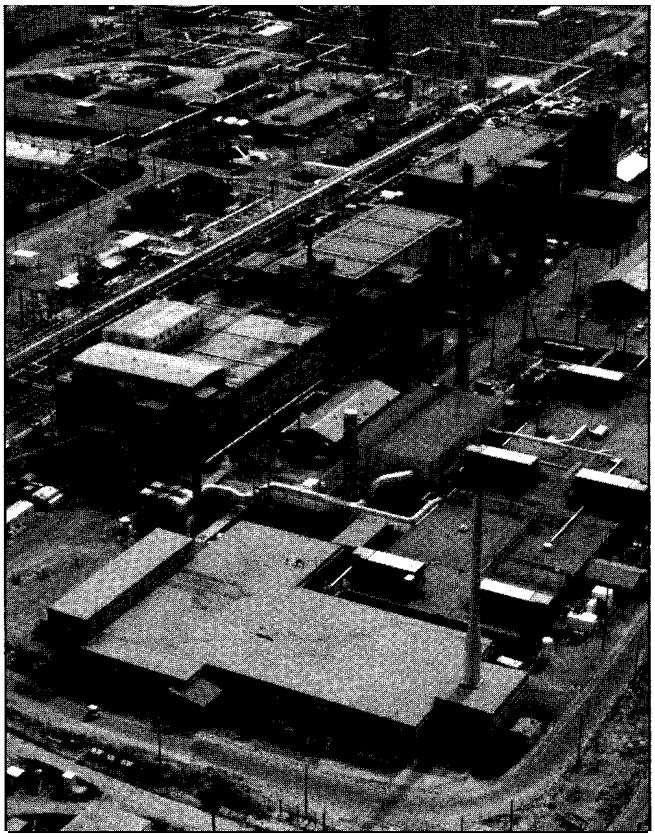
Source Term Estimates

Source term estimates rely heavily on a variety of information from historical records. Original data like those in logbooks and analytical notebooks are more valuable than summary data in monthly or annual reports. Environmental monitoring data can be used to check source term estimates or to validate source term calculations. Some source terms can be calculated from knowledge of reactor and fuel reprocessing operations.

After a source term is developed, the amounts and locations of contamination in the environment can be estimated. If the amount of contamination has been measured, it is sometimes possible to estimate the source term using these data. Environmental monitoring records are generally available for radioactive materials for most of the time periods of interest, but records were not available for chemicals until recent years.

If source terms cannot be calculated directly, information from other studies or facilities may be used to make estimates. Average release rates and contaminant concentrations measured in air emissions from similar production facilities can be used for comparison or to fill in missing information in a source term calculation.

Sources of the Releases



Measurements of stack releases from the fuel processing canyons become part of the Phase II source term.

The SRS contained five production reactors, which produced tritium, plutonium, and other products by irradiating target materials with neutrons. Support facilities included two chemical separations plants, a heavy water extraction plant, a nuclear fuel and target fabrication facility, and waste management facilities.

The separations plants in the H and F Areas dissolved spent reactor fuel and recovered and separated uranium, neptunium, and plutonium. The liquid used in the dissolving process contained many of the fission products that were in the fuel. Some of these fission products were gases and volatile elements (elements that can be released as vapors). Facility exhaust air that contained fission products was filtered and released through exhaust stacks. Radioactive gases included krypton and xenon, which are not chemically active in the body. Volatile elements included iodine, which tends to collect in the thyroid gland and can cause thyroid disease. The releases of these gases and volatile elements are examples of atmospheric source terms.

The SRS production reactors were heavy water moderated and cooled reactors. This means that heavy water (deuterium oxide or D_2O) was used to slow down the neutrons that were produced in the reactor, and heavy water was circulated in a closed system through heat exchangers to cool the reactors. Water from the Savannah River and Par Pond provided the secondary cooling water for the heat exchangers. Occasionally, cracks in the heat exchangers led to contamination of secondary cooling water with tritium, which was then discharged into the Savannah River.

Tritium production and recycling has been an important activity at the Site. Both routine and accidental releases of tritium occurred from the reactors and tritium processing facilities.

Site research facilities also released chemical and radioactive materials into the air and water. In general, these releases are expected to be much smaller than those from separations and production facilities.

Public Participation

Public involvement is a key part of the dose reconstruction project. During the course of the project, workshops and meetings will be held to explain the progress being made and to ask for ideas from people who are interested in the work. For more information or to provide input, call *Radiological Assessments Corporation* at 800-637-4766.